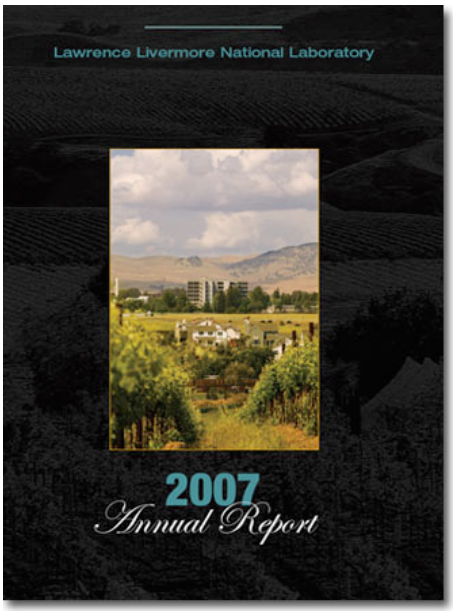
LAWRENCE LIVERMORE REPORT

A weekly collection of scientific and technological achievements from Lawrence Livermore National Laboratory: June 23-June 30, 2008.

Annual report recalls success of 2007

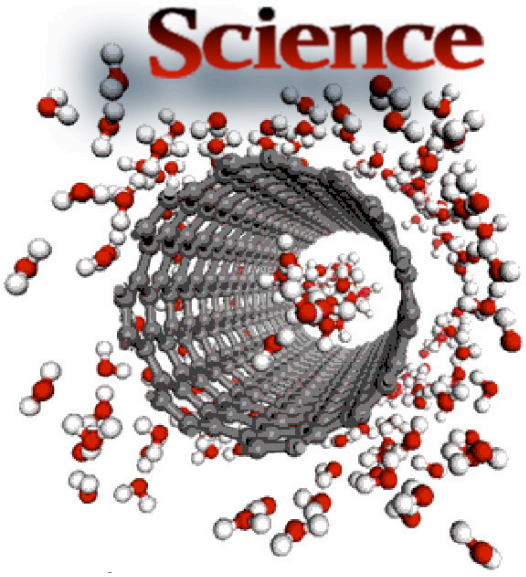


Astonishing computational breakthroughs in stockpile stewardship. Major milestones in the National Ignition Facility. New detection tools to ensure homeland security. Key developments in alternative energy. Contributions to climate studies that would lead to a Nobel Prize.

These are just a handful of the achievements at Lawrence Livermore National Laboratory during 2007. The Lab's *Annual Report,* now available on the LLNL Website, takes a look at the many accomplishments -- challenges as well as successes -- for 2007, and includes messages from Lab Director George Miller as well as his senior staff.

For a copy of the report, see https://www.llnl.gov/annual07/pdfs/2007Annual.pdf

Researchers peer into water



An NMR spectrum showing features associated with water external and internal to the carbon nanotube

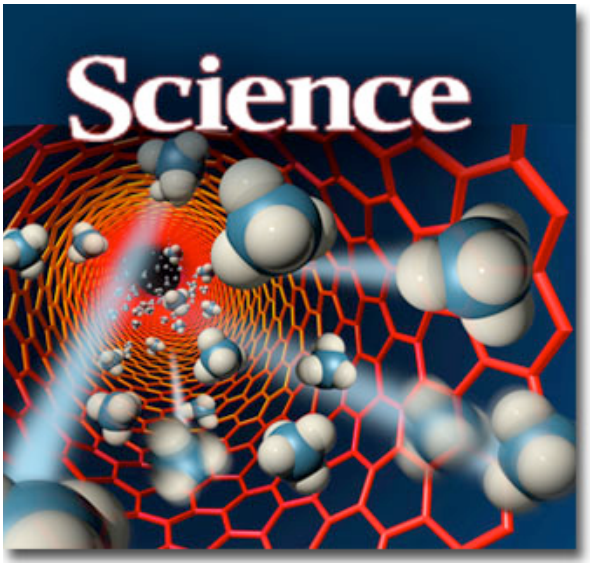
Researchers have identified a signature for water inside single-walled carbon nanotubes, helping them understand how water is structured and how it moves within these tiny channels. This is the first time researchers were able to get a snapshot of water inside the miniature vessels.

Single-walled carbon nanotubes (SWCNTs) offer the potential to act as a unique nanofiltration system. While experiments have demonstrated extremely fast flow in these channels, it is still unclear why, and few studies have experimentally probed the detailed structure and movement of the water within nanotubes.

That's where Laboratory scientists Jason Holt and Julie Herberg come in. Their work, which may have applications in desalination and demineralization, appears in the July edition of *Nanoletters.*

For more information, see https://publicaffairs.llnl.gov/news/news_releases/2008/NR-08-06-09.html

Carbon nanotube research worth its salt



Artist's rendering of methane molecules flowing through a carbon nanotube less than two nanometers in diameter.

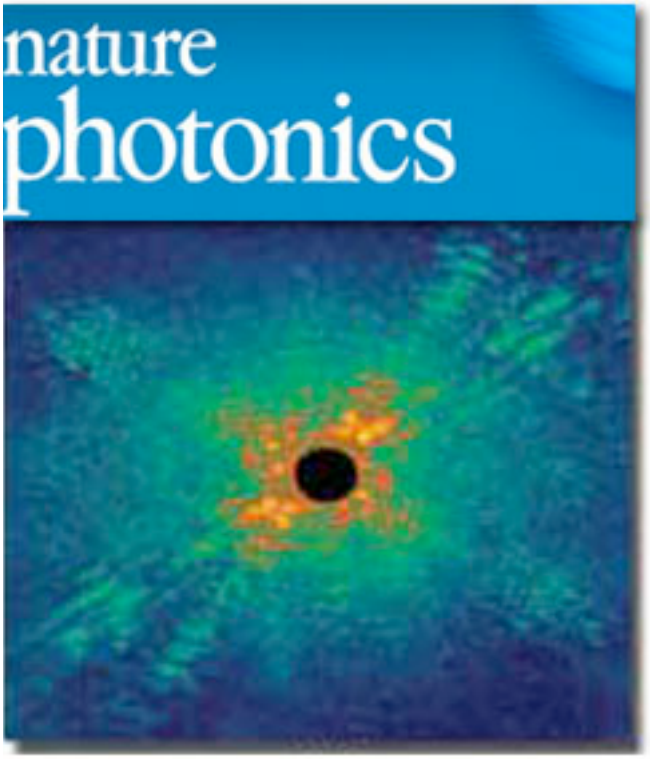
A 2006 research paper on carbon nanotubes offering a cheaper solution to desalination and authored by Lawrence Livermore scientists Olgica Bakajin and Alex Noy, has been named the No. 1 most cited chemistry article in *Science.*

The research involves a nanotube membrane on a silicon chip the size of a quarter that may offer a cheaper way to remove salt from water.

Bakajin and Noy were both recruited to Livermore as "Lawrence Fellows" -- the Laboratory's initiative to bring in talented young scientists. In addition to Bakajin and Noy, current staff scientist Jason Holt and postdoctoral scholar Hyung Gyu Park were first authors of the highly cited article. Other LLNL co-authors included Yinmin Wang, Michael Stadermann and Alexander Artyukhin.

The original *Science* article can be found on the Web at http://www.sciencemag.org/cgi/content/full/312/5776/1034. For more information on the technology, see https://publicaffairs.llnl.gov/news/news_releases/2006/NR-06-05-06.html

A look into the nanoscale



Sample evolution revealed by coherent X-ray diffraction.

Lawrence Livermore researchers have captured time-series snapshots of a solid as it evolves on the ultra-fast timescale.

Using femtosecond X-ray free electron laser (FEL) pulses, the team, led by Anton Barty, is able to observe condensed-phase dynamics such as crack formation, phase separation, rapid fluctuations in the liquid state or in biologically relevant environments.

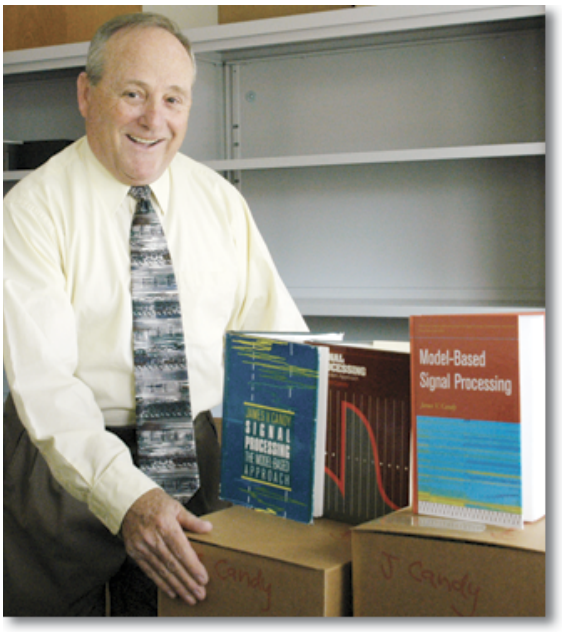
"The ability to take images in a single shot is the key to studying non-repetitive behavior mechanisms in a sample," Barty said.

As the femtosecond laser blasts the sample, it is destroyed, but not before the scientists created images with a 50-nanometer spatial resolution, and a 10-femtosecond shutter speed. (A femtosecond is one billionth of one millionth of a second. For context, a femtosecond is to a second as a second is to about 32 million years.) The technique is necessary to study ultrafast dynamics of non-crystalline materials at nanometer-length scales.

"This experiment opens the door to a new regime of time-resolved experiments in mesoscopic dynamics," Barty said

The research appears in the June 22 online edition of *Nature Photonics* (see http://www.nature.com/nphoton/journal/vaop/ncurrent/abs/nphoton.2008.128.html) and on *Science Daily* at http://www.sciencedaily.com/releases/2008/06/080623135022.htm

Lab engineers wins Acoustical Society medal



Jim Candy

The Acoustical Society of America (ASA) has named Lawrence Livermore engineer James V. Candy the recipient of its Helmholtz-Rayleigh Interdisciplinary Silver Medal for his contributions to signal processing and underwater acoustics. The Silver Medal is awarded to ASA members whose work overlaps more than one technical area. The award will be presented July 2 in Paris at the society's international meeting.

"Receiving the interdisciplinary Silver Medal award from the Acoustical Society of America is an overwhelming honor," says Candy.

Photo of the week

Back to class -- Each summer Lawrence Livermore welcomes local science teachers as summer interns for the college-accredited Teacher Research Academy conducted in partnership between LLNL and the UC Davis School of Education Edward Teller Education Center. ETEC's mission is to provide professional development programs for middle and high school science teachers tied to cutting-edge LLNL science, in order to improve the quality of secondary science, technology, engineering and math education in California schools.

LLNL is managed by Lawrence Livermore National Security, LLC, for the U.S. Department of Energy's National Nuclear Security Administration.

LLNL applies and advances science and technology to help ensure national security and global stability. Through multi-disciplinary research and development, with particular expertise in high-energy-density physics, laser science, high-performance computing and science/engineering at the nanometer/subpicosecond scale, LLNL innovations improve security, meet energy and environmental needs and strengthen U.S. economic competitiveness. The Laboratory also partners with other research institutions, universities and industry to bring the full weight of the nation's science and technology community to bear on solving problems of national importance.

To send input to the *Livermore Lab Report,* send e-mail mailto:labreport@llnl.gov.

The *Livermore Lab Report* archive, including today's issue, is available at:
https://publicaffairs.llnl.gov/news/lab_report/2008index.html